Remarks

Thorough examination by the Examiner is noted and appreciated.

The claims have been amended and new claims added to clarify Applicants invention. No new matter has been added.

For example support for the amendments is found in the previously presented claims as well as the specification at:

Beginning at page 7, line 11:

"Accordingly, it is the primary object of the present invention to provide a method and apparatus for generating a processing plasma using RF power **in which the plasma density is uniform across the entire surface** of the semiconductor wafer being processed.

Another object of the invention is to provide a method and apparatus as mentioned above which controls the RF power used to generate the plasma in a manner that **achieves uniformity of the RF electric field over the entire face of the semiconductor wafer**.

Another object of the invention is to provide a method and apparatus of the type described above in which an electrode used to generate an RF electrical field is **integrated into an electrostatic chuck and includes**

separate electrode portions that are individually controllable."

A still further object of the invention is to provide a method and apparatus of the type generally described above that is capable of sensing non-uniformity in the plasma density over the wafer and taking corrective action to eliminate the nonuniformity."

Beginning on line 13, page 12:

"According to the present mention, the undesired processing variations can be substantially reduced or, in some cases, eliminated using a novel method and the apparatus shown in Fig. 4. In accordance with the present invention, a novel ECS plate 32 is formed with three separate electrode portions or zones, 34, 36, 38 which are concentric and insulated from each other. This insulated relationship may be created by separating the electrodes portions 34-38 from each other by an insulating dielectric, or by simply spacing the electrode portion from each other."

Beginning on line 10, page 13:

"RF energy created by a first RF power source 14 is conditioned by a **matching network** 42 and capacitively coupled to the electrode plate 32 by means of variable capacitors 50, 52, 54 which are respectively related to and connected with electrode portion 34, 36, 38. The matching network 42 functions to minimize the reflection of RF power back from the processing chamber 30 which would otherwise reduce the efficiency of the generated plasma. Such power reflection is generally caused by a mismatch in the impedance of the RF power source 44 and a load which is formed by the

combination of the ESC and the plasma generated within the chamber 30."

Beginning on line 11, page 15:

"A second electrode 41 is provided near the top of the chamber 40. Electrode 41 is connected through a second matching network 48 to a second RF power source 46. One of the RF power generators 44, 46 may be of a lower frequency, and the other of a higher frequency. Each frequency causes different physical phenomena in the plasma. For example a lower frequency excitation causes direct acceleration of the electrons and ions. This results in higher energy ions and a higher plasma potential. A high frequency excitation leads to the formation of a plasma having a lower potential then when excited by a low frequency signal of similar power levels. **Dual frequency systems thus permit higher ion densities in the plasma** which result in a higher ion flux into the wafer while **permitting the sheath potential at the wafer to be independently controlled by the bias RF power supply 44**. This significantly affects the etch rate - a higher density of ion flux into the wafer will usually result in a higher etch rate."

Beginning on line 14, page 16:

"Attention is now directed to Fig. 7, wherein the curve plot 56 represents the density of the plasma across the face of the wafer 12 using the novel apparatus of the present invention. **The use of the novel electrode plate 32 in combination with the tunable capacitors 50, 52, 54 can be seen to result in a flatter, more uniform density curve 56, compared to the density**

curve 26 shown in Fig. 2. This more uniform plasma density which is generated over the face of the wafer 12 is the result of the fact that the RF bias voltage is adjusted over the face of the wafer 12 so as to produce an RF electric field that is spatially uniform. **This can be better seen by reference to Fig. 8 which shows that the change of the RF bias voltage applied to the electrode 32 as a function of time is essentially flat or uniform over the diameter "d" of the wafer 12."**

Claim Rejections under 35 USC 102

1. Claims 1-9 and 20-29 stand rejected under 35 USC 102(b) as being anticipated by Dible et al. (US 6,239,403).

Dible et al. discloses a power segmented electrode which is individually supplied with RF power to provide for uniform processing of a substrate (see Abstract). In one embodiment, Dible et al. discloses a segmented electrode and an active mechanism to control power delivered to different zones of the segmented electrode including a capacitive network for distributing power to a plurality of electrodes which may be segmented into concentric annular rings (see col 3, lines 30-49; Figure 5). Dible et al. also discloses a passive network system (Figure 2) that is incorporated into an electrostatic chuck using

a DC bias and which includes a passive RF power splitter for delivering power to different segments of the segmented electrode (col 5, lines 37-57). Dible et al. does not specifically disclose that the segmented electrode with a capacitive network (Figure 5) is incorporated into an electrostatic chuck.

Dible et al. does disclose a capacitive network with a plurality of variable capacitors (22) and a plurality of current sensors (24) to provide active control of the variable capacitors by means of **a feedback loop between the current sensors and the variable capacitors** to control the percentage of power sent to the electrodes (col 6, lines 13-24). Dible et al. teaches that the capacitors are automatically adjusted by signals from the current sensors to compensate for deviations from uniformity of **processing the substrate in an annular zone of the substrate facing a respective one of the annular electrodes** (col 2, lines 41-47).

Thus Dible fails to disclose several elements of Applicants invention, including those elements in **bold type**:

"A method of controlling the **spatial distribution of RF**

power used to generate a plasma for processing a semiconductor device process wafer to **achieve a uniform density of said plasma over an entire face of said process wafer**, comprising the steps of:

(a) producing RF power;

(b) delivering the RF power to each of a plurality of separate electrode zones **according to a matching network**, said RF power **individually deliverable to separate electrode zones at a selected RF power level**, said separate electrode zones comprising an electrostatic chuck; and

(c) **separately controlling** the RF power delivered to each of the electrode zones so as to produce a desired spatial distribution of RF power **in response to determining a density of said plasma across said process wafer face**, said **desired spatial distribution of RF power selected to achieve a uniform density of said plasma across said entire surface of said process wafer**."

Thus, Dible is clearly insufficient to anticipate Applicants invention.

"A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987).

"The identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989).

2. Claims 1-3, 7-8, and 20 stand rejected under 35 USC 102(e) as being anticipated by Liu et al. (US 2003/0038112).

Liu et al. disclose a method for optically monitoring the **integrated power spectra** by optical sensors (176; Figure 1; paragraph 0048) located in an upper electrode (60) over selected areas of a process wafer(50), where the upper electrode is segmented (Figure 2A) and where each segment of the electrode **is supplied by a separate RF power supply** (82; Figure 2b, 2C) **each RF power supply controllable** to alter the RF power of an individual electrode segment (see Abstract; each RF power supply is controllable to adjust the RF power level of a plasma **based on differences in an integrated power spectra from a predetermined**

value (paragraph 0018). **Liu et al. disclose monitoring the power spectrum over portions of the wafer face (see Figure 9; paragraph 0071) and teach that the magnitude of the total power spectrum should be the same over monitored portions of the wafer (Pa-Pc; Figure 9).** The RF power is adjusted to an electrode segment **to adjust the magnitude of the total power spectrum** to a predetermined value. Liu et al. teach that in achieving overall plasma processing uniformity in endpoint detection in an etching process may include predetermined application of different RF power levels to the overhead electrode as well as in-situ adjustment based on comparison **to a predetermined level of a magnitude of the power spectrum of the plasma** (paragraphs 0081 and 0082).

Thus Liu et al. fails to disclose several elements of Applicants invention, including those elements in **bold type**:

"A method of controlling the spatial distribution of RF power used to generate a plasma for processing a semiconductor device process wafer to **achieve a uniform density of said plasma over an entire face of said process wafer**, comprising the steps of:

(a) producing RF power;

(b) **delivering the RF power** to each of a plurality of separate electrode zones **according to a matching network,** said RF power **individually deliverable to separate electrode zones at a selected RF power level, said separate electrode zones comprising an electrostatic chuck;** and

(c) separately controlling the RF power delivered to each of the electrode zones so as to produce a desired spatial distribution of RF power **in response to determining a density of said plasma across said process wafer face,** said **desired spatial distribution of RF power selected to achieve a uniform density of said plasma across said entire surface of said process wafer.**"

Thus, Dible is clearly insufficient to anticipate Applicants invention.

"A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California,* 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987).

"The identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989).

"A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987).

"The identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989).

Conclusion

The cited references, individually or in combination, fail to produce Applicants invention and are therefore insufficient to make out a *prima facie* case of anticipation or obviousness with respect to Applicants disclosed and claimed invention.

The claims have been amended and new claims added to further clarify Applicants' disclosed and claimed invention. A favorable consideration of Applicants' claims is respectfully requested.

Based on the foregoing, Applicants respectfully submit that the Claims are now in condition for allowance. Such favorable action by the Examiner at an early date is respectfully solicited.

In the event that the present invention as claimed is not in condition for allowance for any reason, the Examiner is respectfully invited to call the Applicants' representative at his Bloomfield Hills, Michigan office at (248) 540-4040 such that necessary action may be taken to place the application in a condition for allowance.

Respectfully submitted,

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Signature

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Date

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